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# **THE COORDINATION OF CAPITAL INCOME AND PROFIT TAXATION WITH CROSS-OWNERSHIP OF FIRMS**

by

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## **Abstract:**

This paper investigates the scope for international coordination of capital income and profit taxation. The paper considers a world of many symmetric countries where public goods are financed by taxes on capital income and on profits. In the open economy, the authorities have at their disposal a residence-based saving tax, a source-based investment tax and a profit tax. Determinants of the tax mix are the foreign ownership of domestic firms, if any, and the extent to which the profit tax is feasible. Noncooperative tax policy in the open economy is compared to the corresponding tax policy in the closed economy where a single tax instrument determines the wedge between the returns to saving and investment. There generally is a scope for a coordinated increase in this tax wedge if the noncoordinated tax wedge is negative or very large, and vice versa. There is no need for tax coordination if there is no foreign ownership or if profits are taxed fully. The cases for tax coordination when in the noncoordinated scenario there either is no saving tax or no investment tax are also considered.

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## 1. *Introduction*

With increased international capital mobility, national capital income tax policies are becoming increasingly interdependent. In recognition of this, there is an active discussion of capital income tax coordination at the European and OECD levels (see OECD (1991), Ruding Report (1992), Keen (1993) and Sørensen (1993)). To guide such coordination efforts, it is important to identify what externalities are created by national capital income tax policies. To date, a relatively small literature has addressed this question. Razin and Sadka (1991), in particular, consider a model where labor and capital are inputs into a production function with constant returns to scale. They conclude that countries have no reason to coordinate either saving or investment taxes if the world rate of interest is given. Bucovetsky and Wilson (1991) consider labor, saving and investment taxes in a similar model where saving and the world interest rate, though, are endogenous. They find that still there is no scope for tax coordination if countries have access to both saving and investment taxes. Krellove (1992) instead find that the coordination of investment taxes alone may entail either a lower or a higher investment tax.

Using the framework of Huizinga and Nielsen (forthcoming), this paper extends the analysis of capital income tax coordination in several directions. First, in addition to residence-based saving taxation and source-based investment taxation, the paper introduces the possibility of the (partial) taxation of profits or rents. Second, the paper assumes that foreigners may own part of domestic firms, and thus receive part of domestic rents. The foreign ownership of domestic rents may lead one to expect that without coordination source-based capital income taxes are too high, as the incidence of investment and rent taxes is partially borne by foreigners. While such overtaxation may occur, this paper shows that the opposite is also possible. The undertaxation of source-based capital income can occur through an externality of domestic tax policy on the foreign supply of savings. Specifically, the domestic taxation of capital income accruing to foreigners (late in life) stimulates these foreigners' savings (early in life). Such additional foreign savings bring about higher foreign saving tax revenues, if these foreign savings are taxed. An increase in any country's saving-investment tax wedge will then increase every country's saving tax base, and thus enhance all countries' welfare. This paper thus demonstrates that there may be a rationale to coordinate international capital income tax policy, even if all countries are small and take the world interest rate as given. The argument requires some foreign ownership of domestic firms and incomplete rent taxation, while all countries have access to saving and investment taxes. Without any foreign ownership or with complete rent taxation, the model is consistent with Bucovetsky and

Wilson's (1991) finding that there is no scope for saving and investment tax coordination.

Ample opportunities for individuals to invest funds abroad seriously erode the efficacy of residence-based capital income taxes. To reflect this, the paper considers the case where the saving tax instrument no longer exists. In this instance, the tax authorities perceive the excess burden of raising certain needed tax revenues through the remaining investment (and profit) taxation to be higher. As a result, tax coordination tends to lead to a larger saving-investment tax wedge. Similarly, in the absence of the investment tax (with the saving and profit taxes remaining), coordination can lead to a larger saving-investment tax wedge. With only investment taxation, however, it is also possible that coordination leads to lower investment taxes to counter the beggar-neighbor overtaxation of domestic profit income accruing to foreign residents.

To set the stage, section 2 next considers capital income tax policy in a small open economy that has access to saving, investment and (some) profit taxation. Section 3 then turns to the optimal capital income tax policy in a closed economy, where a single tax instrument affects the saving-investment tax wedge. Section 4 examines the scope for international tax coordination for the benchmark case where all countries have access to saving, investment and (some) profit taxation, while section 5 considers coordination in the cases where either the saving or investment tax instrument is not available. Section 6 concludes.

## 2. *Tax policy in the small open economy*

The world consists of many small symmetric countries and it exists for two periods. Each country takes the world interest rate,  $r$ , as given. Each country's representative agent receives an endowment,  $Y$ , of a single good in the first period. This endowment is allocated between first period consumption,  $C_1$ , and saving,  $S$ . In the first period, firms make investments,  $K$ . Invested capital is only productive in the second period. In the second period, households spend their net-of-tax return from saving and profit income to consume  $C_2$ . Consumers also enjoy a public good,  $G$ , provided in the second period. To finance the public good, the government can impose a tax,  $u$ , on saving and a tax,  $v$ , on investment to be paid in the second period. Further, second period firm profits are taxed at a rate  $z$ . Profits are positive because there is some factor of production, e.g. land, in inelastic supply or, alternatively, there are decreasing returns to scale in capital investments. The investment tax bill,  $vK$ , is deductible from taxable profits. The profit tax rate,  $z$ , cannot exceed a maximum profit tax rate,  $\bar{z} \leq 1$ . There are no other restrictions on the sizes or signs of the three tax rates,  $u$ ,  $v$  and  $z$ . Finally, we assume that a firm's profits can be in part or wholly

foreign-owned. In particular, let us assume that a share  $\alpha$  of each country's firms is owned by foreigners.

Firms produce an output  $F(K)$  in the second period, where the production function  $F$  is strictly concave. Firms' after-tax profits are equal to  $(1 - z)[F(K) - (1 + r + v)K]$ , where  $1 + r + v$  is the user cost of capital. The maximization of profits on the part of firms yields the following optimal investment rule,

$$F'(K) = 1 + r + v \quad (1)$$

Households face the following two-period budget constraint,

$$C_2 = (Y - C_1)(1 + r - u) + (1 - z)(1 - \alpha) [F(K) - (1 + r + v)K] + (1 - z^*) \alpha^* [F(K^*) - (1 + r + v^*)K^*] \quad (2)$$

where stars denote foreign variables.

Households derive utility from consumption in both periods and from the public good,  $G$ , so that lifetime utility can be written as  $U(C_1, C_2) + V(G)$ . The first order condition regarding the private consumption choice is as follows,

$$U_1 = U_2(1 + r - u) \quad (3)$$

The government's budget constraint stipulates that overall tax revenues equal the provision of the public good,  $G$ , as follows,

$$0 < G = uS + vK + z [F(K) - (1 + r + v)K] \quad (4)$$

Tax policy is set so as to maximize the utility of the representative agent. Formally, the government faces the problem of choosing the tax rates  $z$ ,  $u$  and  $v$  so as to maximize the following Lagrangean expression,

$$\begin{aligned}
L = & U(C_1, (Y - C_1)(1 + r - u) + (1 - z)(1 - \alpha)[F(K) - (1 + r + v)K] + \\
& (1 - z^*) \alpha^* [F(K^* - (1 + r + v^*)K^*)] + V(G) + \\
& \lambda(uS + vK + z[F(K) - (1 + r + v)K] - G) + \mu(\bar{z} - z)
\end{aligned} \tag{5}$$

where  $\lambda$  and  $\mu$  are the Lagrange multipliers associated with the government budget constraint (4) and the maximum profit tax,  $\bar{z}$ .<sup>1</sup>

The optimality conditions associated with (5) regarding the tax rates  $z$ ,  $u$  and  $v$  and the volume of public goods,  $G$ , can be stated as follows,

$$[\lambda(1 + (1 - \alpha)up) - U_2(1 - \alpha)][F(K) - (1 + r + v)K] - \mu = 0 \tag{6}$$

$$-U_2 + \lambda(1 - u)e_u = 0 \tag{7}$$

$$-U_2(1 - z)(1 - \alpha) + \lambda((1 - z)(1 + (1 - \alpha)up) - e_v v) = 0 \tag{8}$$

$$V'(G) - \lambda = 0 \tag{9}$$

where  $e_v = - (dK/dr)/K$  is the semi-elasticity of investment with respect to the investment tax,  $v$ , and  $e_u = - (dS/du)/S$  is the uncompensated semi-elasticity of saving with respect to the saving tax,  $u$ , and  $p$  is the propensity to consume in the first period out of second period income. It can be seen that  $e_u^c = e_u + p > 0$  is the compensated semi-elasticity of saving with respect to the saving tax,  $u$ .

From (4), (7) and (8), we can derive the optimal values of the saving and investment taxes,  $u$  and  $v$ , given the profit tax,  $z$ , as follows,

$$u = \frac{(G - z[F(K) - (1 + r)K])e_v - (1 - z)^2 K \alpha}{e_v S + (1 - z)^2 K(1 - \alpha)e_u^c} \tag{10}$$

$$v = \frac{(1 - z)[(G - z[F(K) - (1 + r)K])(1 - \alpha)e_u^c + \alpha S]}{e_v S + (1 - z)^2 K(1 - \alpha)e_u^c} \tag{11}$$

Note that the optimal investment tax,  $v$ , in (11) approaches zero, as the profit tax,  $z$ , approaches unity. This confirms the result in Gordon (1986), Frenkel et al. (1991), Bruce (1992)

and others that investment taxes are not part of the optimal tax scheme if profits can be fully taxed. Also note that the saving tax,  $u$ , in (10) can be either positive or negative, while the investment tax,  $v$ , in (11) is non-negative. The exact signs of the taxes  $u$  and  $v$  depend on the desired level of tax revenues and public goods as well as on the maximum profit tax rate,  $\bar{z}$ . To be precise, we can distinguish five cases in increasing need for tax revenue with  $\alpha > 0$ , as summarized in Table 1. The variable  $x$  in the table is the overall capital income tax wedge resulting from saving and investment taxation, i.e.  $x = u + v$ . The five cases are reviewed in turn.

In case i), the maximum profit tax rate,  $\bar{z}$ , is not binding so that  $\mu = 0$  in equation (6). The marginal cost of public funds in terms of second period consumption, denoted  $\eta$  (and equal to  $\lambda/U_2$ ), is then given by  $\eta = (1 - \alpha)e_u^c / (e_u^c - \alpha p) < 1$  for  $\alpha > 0$ . Equation (8) then immediately yields that optimally the investment tax,  $v$ , is 0, while using (7) we see that the optimal saving tax,  $u$ , is negative at  $u = -\alpha / (1 - \alpha)e_u^c < 0$  for  $\alpha > 0$ . A negative saving tax,  $u$ , allows the tax authorities to redistribute foreign profit income to domestic residents.<sup>2</sup> In case ii), the profit tax constraint,  $\bar{z}$ , is just binding so that we have  $v = 0$ ,  $u < 0$ . The cost of funds,  $\eta$ , is still less than one. In case iii), a positive investment tax,  $v$ , is used as a substitute profit tax to in part finance the negative saving tax. Again, we have  $\eta < 1$ . In case iv), the optimal saving tax,  $u$ , is just equal to zero, while from (6)-(8) we see that the investment tax,  $v$ , is equal to its national income maximizing value,  $\alpha(1 - \bar{z})/e_v$ . The cost of funds,  $\eta$ , equals unity.<sup>3</sup> Finally, in case v) the saving and investment taxes,  $u$  and  $v$ , are both positive, and the cost of public funds,  $\eta$ , exceeds one.

In the absence of cross-ownership, i.e. with  $\alpha = 0$ , only the profit tax is used at low revenue requirements. At higher revenue requirements, the profit tax restriction is binding and the saving and investment taxes are jointly positive. The main results are summarized as follows,

**PROPOSITION 1.** A low revenue requirement may imply that the profit tax is below its maximum. In this instance, saving is optimally subsidized, if domestic firms are at least in part foreign-owned while the investment tax is set to zero. At higher revenue requirements, the profit tax restriction is binding. In this instance, the investment tax is positive if profit taxation is less than complete. A positive investment tax can still be combined with a negative saving tax if domestic firms are partly foreign-owned.

To aid the later analysis of tax coordination, it is useful to examine what combination of saving and investment taxes maximizes the government's overall capital income and profit tax

revenues. Using (7) and (8), we can derive that the capital income tax wedge,  $\bar{x}^n$ , that maximizes overall tax revenues with  $z = \bar{z}$  is given by,

$$\bar{x}^n \equiv \frac{1}{e_u} + \frac{(1-\bar{z})}{e_v} + p \frac{(1-\bar{z})(1-\alpha)}{e_v e_u} \quad (12)$$

The first term in (12),  $1/e_u$ , corresponds to the saving tax rate that maximizes combined saving and profit tax revenues if the authorities can only levy saving and profit taxes. The second term in (12),  $(1-\bar{z})/e_v$ , is the investment tax rate that maximizes combined investment and profit tax revenues if the authorities instead only impose investment and profit taxes. The right hand side of (12) exceeds the sum of  $1/e_u$  and  $(1-\bar{z})/e_v$  if the propensity to consume in the first period out of second period income,  $p$ , is positive. In this instance, there are synergies between the investment and saving taxes, as a higher investment tax,  $v$ , has a positive income effect on saving and thus increases the scope for saving taxation.

### 3. *Tax policy in the closed economy*

In this section, we consider the optimal capital income and profit tax policy in a closed economy. The closed economy is identical to any of the small open economies considered in the previous section. Tax policy in the closed economy corresponds to the tax policy that results from policy coordination in the many-country case. The discussion of tax policy in the closed economy in this section sets the stage for a discussion of policy coordination in the next section. In the closed economy, the tax authority has a single tax instrument,  $x$ , to introduce a tax wedge between the gross return to investment and the net return to saving. The tax  $x$  can be thought to be levied on saving so that the net return to saving is  $r - x$ , while  $r$  is the return to investment. In the closed economy, the saving-investment balance implies that  $S = K$ . As before, the tax authority can tax profit at a rate  $z \leq \bar{z}$ .

Profit maximization on the part of firms now yields the following investment rule,

$$F'(K) = 1 + r \quad (13)$$

The budget constraints on the part of consumers and the government are given by,

$$C_2 = (Y - C_1)(1 + r - x) + (1 - z)[F(K) - (1 + r)K] \quad (14)$$



$$0 < G = x S + z [F(K) - (1+r)K] \quad (15)$$

Again, the government chooses tax policy to maximize the utility of the representative agent. Specifically, the government chooses the tax rates  $x$  and  $z$  so as to maximize the following Lagrangean expression,

$$L = U(C_I, (Y-C_I)(1+r-x) + (1-z)[F(K) - (1+r)K]) + \lambda(x S + z [F(K) - (1+r)K] - G) + \mu(\bar{z}-z) \quad (16)$$

The optimality conditions with respect to the tax instruments  $z$  and  $x$  corresponding to (5) are as follows,

$$[-U_2(1 + z \frac{e_s p}{e_u e_v}) + \lambda(1 + x p \frac{e_s}{e_u} + z \frac{e_s p}{e_u e_v})][F(K) - (1 + r)K] - \mu = 0 \quad (17)$$

$$-U_2 \left[ 1 - z \frac{dr}{dx} \right] + \lambda \left[ 1 - x e_s - z \frac{dr}{dx} \right] = 0 \quad (18)$$

$$V(G) - \lambda = 0 \quad (19)$$

In these expressions,  $e_s = -(dS/dx)/S$  is the semi-elasticity of saving with respect to the tax wedge  $x$ , accounting for any endogenous change in the interest rate,  $r$ . The semi-elasticity,  $e_s$ , can be expressed as follows,

$$e_s = (1 - \frac{dr}{dx})e_u - (1 - z)\frac{dr}{dx}p \quad (20)$$

Next, the saving-investment balance implies that  $dr/dx$  can be found as,

$$\frac{dr}{dx} = \frac{e_s}{e_v} \quad (21)$$

so that  $e_s$  can be written as follows,

$$e_s = \frac{e_v}{e_v + (1 - z)p + e_u} e_u \quad (22)$$

In (22), we will assume that  $e_u > 0$  to guarantee that  $e_s > 0$ .<sup>4</sup>

Depending on the requirement for public good finance, the profit tax may or may not optimally be equal to its maximum value  $\bar{z}$  in the optimal tax scheme. Specifically, if with  $z = \bar{z}$  and  $x = 0$ , we have  $V'(G) < U_2$ , then we optimally have  $z < \bar{z}$  and  $x = 0$  so that the cost of public funds,  $\eta$ , is equal to unity. Alternatively, if with  $z = \bar{z}$  and  $x = 0$ , we have  $V'(G) > U_2$ , then we optimally have  $z = \bar{z}$  so that  $\eta > 1$ .<sup>5</sup> These insights regarding the optimal tax policy in the closed economy are summarized in Table 1 and in the following proposition,

**PROPOSITION 2.** If the tax revenue requirement is relatively weak, then optimally the profit tax is not used in full, and the capital income tax not at all in the closed economy. If the tax revenue requirement is sufficiently strong, however, the profit tax is used in full, and any remaining tax revenue needs are met by a positive capital income tax.

To conclude the section, we can note that the capital income tax wedge,  $\bar{x}^u$ , that maximizes overall profit and capital income tax revenues with  $z = \bar{z}$  can be found from (18), (21) and (22) to be given by,

$$\bar{x}^a = \frac{1}{e_u} + \frac{1 - \bar{z}}{e_v} + p \frac{1 - \bar{z}}{e_v e_u} \quad (23)$$

It is interesting to compare  $\bar{x}^n$  in (12) with  $\bar{x}^u$  in (23). It is immediately seen that  $\bar{x}^a > \bar{x}^n$  if  $\alpha > 0$  given  $p > 0$  and  $\bar{z} < 1$ . To see why, note that an increase in the saving-investment tax wedge,  $x$ , increases the gross, tax-inclusive cost of capital in the open as well as in the closed economy. A higher cost of capital leads to lower domestic and foreign profit income alike in the open economy if  $\alpha > 0$ . A lower foreign profit income induces higher foreign saving and thus higher foreign saving tax revenues. This positive foreign tax revenue effect is ignored by the domestic tax authority in the absence of tax coordination. The noncoordinated tax wedge,  $\bar{x}^n$ , in (12) that maximizes overall tax revenues in the open economy is therefore perceived to be lower than the tax wedge,  $\bar{x}^u$  in (23) that maximizes overall tax revenues in the closed economy.

#### 4. *The scope for international income tax coordination.*

This section considers the scope for the international coordination of capital income and

profit taxation. Tax policy coordination at a global level ultimately leads to the optimal tax policy for the closed economy, as outlined in the previous section. Generally, policy coordination is called for, if national tax policies cause first-order international externalities on private welfare or public revenues. At the outset, it is worth contemplating what tax policy spill-overs may have to be internalized through tax policy coordination. First, with positive foreign receipts of domestic profits, there exists an immediate national incentive to tax foreign citizens by way of the domestic profit or investment tax. Tax revenues thus obtained may even be used to subsidize domestic saving, as seen before. Generally, the called-for tax coordination in this instance reduces the level of source-based capital income taxes and of public goods, while any saving subsidy is eliminated. As a second externality, domestic profit and investment taxes may positively affect foreign saving and saving tax revenues. Domestic source-based income taxes, as borne by foreigners, reduce these foreigners' net-of-tax income received in the second period, thereby stimulating their first-period (taxed) saving. Both externalities, it is worthwhile to note, require foreigners to receive some net-of-tax profit income from domestic firms. As a third externality, domestic tax policy generally affects the endogenous world interest rate, and thus foreign saving and investment tax revenues. Higher domestic saving taxes, for instance, tend to raise the world interest rate, thereby stimulating foreign saving giving rise to higher foreign saving tax revenues. This third externality may be favorable, depending on whether it exists in isolation of the other two externalities.

Generally, all three externalities exist at the same time, and a formal analysis is called for to ascertain the need for policy coordination. To start, without coordination the open-economy saving-investment tax wedge, denoted  $x^n$ , equals the sum of  $u$  and  $v$  in (10) and (11). At the same time, let  $x^a$  stand for the optimal saving-investment tax wedge in the closed economy. Clearly, there is a scope for coordinating capital income taxes if  $x^n$  and  $x^a$  differ. Specifically, the saving-investment tax wedge in the open economy should be increased if  $x^a > x^n$ , and vice versa. We have  $x^a > x^n$ , if increasing the overall tax wedge,  $x$ , beyond  $x^n$  is perceived to lead to a relatively larger increase in public good provision in the closed economy than in the open economy. Formally, this is the case if,

$$\left[ -\frac{dV/dx}{dU/dx} \right]_{x=x^n}^a > \left[ -\frac{dV/dx}{dU/dx} \right]_{x=x^n}^n = 1 \quad (24)$$

In the multi-country case, each country is indifferent between generating more tax revenues by a higher saving tax or by a higher investment tax, if the two tax rates are at their optimal values

as in (10) and (11) if  $z^n = \bar{z}$ . For convenience, we will assume that any increase in the wedge,  $x^n$ , in the open economy occurs through a higher value of the saving tax,  $u^n$ . Using (7) and (18), we find that condition (24) for a required increase in the noncooperative tax wedge is equivalent to,

$$\frac{1 - \bar{z} e_s / e_v}{1 - x^n e_s - \bar{z} e_s / e_v} (1 - u^n e_u) < 1 \quad (25)$$

where  $u^n$  and  $z^n$  are the noncoordinated saving and profit tax rates, respectively.

Using (10) and (11), we can express the noncoordinated saving and investment taxes,  $u^n$  and  $v^n$ , as a function of, inter alia, the noncoordinated tax wedge,  $x^n$ , as follows,

$$u^n = - \frac{e_v x^n - (1 - \bar{z})\alpha}{e_v + (1 - \bar{z})(1 - \alpha)e_u^c} \quad (26)$$

$$v^n = \frac{(1 - \bar{z})\alpha + (1 - \bar{z})(1 - \alpha)e_u^c x^n}{e_v + (1 - \bar{z})(1 - \alpha)e_u^c} \quad (27)$$

Combining (25) and (26), we can derive that an increase in the saving-investment tax wedge beyond  $x^n$  in the open economy is called for if,

$$x^n > \frac{1}{e_u^c} + \frac{1 - \bar{z}}{e_v} \quad (28)$$

where for now we have assumed that  $\alpha(1 - \bar{z}) > 0$ . The cases where either  $\alpha = 0$  or  $z^n = \bar{z} = 1$  are considered in some detail below.

The right hand side of (28) represents a feasible tax wedge if  $p > 0$ . To see this, note that the overall revenue maximizing capital income tax wedge in the open economy,  $\bar{x}^n$ , in (12) exceeds the right hand side of (28) if  $p > 0$ , while the two are exactly equal if  $p = 0$ . This means that with  $p > 0$  it is in fact possible that  $x^n$  satisfies condition (28) so that coordination results in a higher saving-investment tax wedge. To see why  $p$  matters, remember that a higher tax wedge,  $x$ , increases the required return to investment,  $r + v$ , in the open economy. A higher  $x$ , therefore, lowers the profit income accruing to foreign residents (remember that in deriving (28) we assume that  $\alpha > 0$ ). Only with  $p > 0$ , do the lower foreign profit receipts, following higher domestic profit or investment taxes, result in higher foreign saving and saving tax revenues.

Next, preferences for public goods may be so weak that the restriction on the profit tax

rate may not be binding, i.e.  $z'' < \bar{z}$ . In this case, the investment tax is zero and the profit tax finances a saving subsidy which of course should be removed under coordination. It is likewise easily seen that even if the profit tax restriction is binding and the investment tax is positive, a negative saving-investment tax wedge should be eliminated under coordination.

The results can be summarized as follows,

**PROPOSITION 3.** In the presence of international income effects on saving, a positive and large enough saving-investment tax wedge may be increased under coordination. Otherwise, a positive (negative) saving-investment tax wedge is reduced (eliminated) under coordination.

So far, we have assumed that there is positive cross-ownership of firms, i.e.  $\alpha > 0$ . Next, it is interesting to consider that there is no foreign ownership of domestic firms, i.e.  $\alpha = 0$ . Evaluating (24) and (25) for the case of  $\alpha = 0$  immediately yields that there is no scope for international tax coordination as (25) becomes an equality regardless of the government's financing requirement. The reason is that without foreign ownership, beggar-thy-neighbor mechanisms via profit and investment taxation cannot be operative, and domestic capital income taxation has no income effect on foreign saving and thus neither on foreign saving tax revenues. Further, note that with  $\alpha = 0$  the uncoordinated saving tax,  $u^n$ , cannot optimally be negative, and that the cost of funds,  $\eta$ , is at least equal to unity. Next, we can consider the special case where complete profit taxation is feasible, i.e.  $\bar{z} = 1$ . Evaluating (25) for  $z^n = \bar{z} = 1$ , we again see that (25) becomes an equality which means that there is no scope for tax coordination if profits are fully taxed. With full profit taxation, domestic capital income taxation does not have an income effect on foreign saving and on foreign saving tax revenues. These results can be summarized as follows,

**PROPOSITION 4.** Without any cross-ownership of firms or with full profit taxation, capital income and profit tax policies in the closed and open economy cases coincide so that there is no need for policy coordination.

Proposition 4 corresponds to an earlier result in Bucovetsky and Wilson (1991). These authors consider wage income taxation as well as source- and residence-level capital income taxation in a world with many countries and no cross-ownership of firms. For the situation where countries only have access to the two capital income taxes, they show that the non-cooperative tax

competition equilibrium is constrained efficient so that there is no need for policy coordination. Razin and Sadka (1991) similarly demonstrate, in a model where the world interest rate is given exogenously, that bilateral capital income tax coordination is inconsequential and superfluous. At the outset of this section, we observed that the endogeneity of the international interest rate generally creates international tax revenue externalities. It may, therefore, seem surprising that there is no scope for tax policy coordination in the special case of Proposition 4. The reason is that the presence of both saving and investment taxation allows a country to insulate itself from capital flows occurring in response to other countries' tax policies. It will choose to do so if there is no firm cross-ownership which provides a separate motive for wielding the investment tax instrument. As shown in section 5, the result in Proposition 4 indeed hinges on the availability of both saving and investment taxes.

In the general case where  $z^n = \bar{z}$  and  $\alpha(1-\bar{z}) > 0$ , expression (28) essentially indicates that coordination should lead to an increase in the saving-investment tax wedge, if the noncoordinated tax wedge,  $x^n$ , is rather large, which occurs if there are rather strong preferences for the public good. This observation suggests that equation (28) can be expressed in terms of the (perceived) marginal cost of public funds,  $\eta^n \equiv \lambda^n/U_2$ , in the noncooperative tax equilibrium.<sup>6</sup> In fact using expressions (7) and (8) and noting that  $x^n = u^n + v^n$ , we see that (28) is equivalent to,<sup>7</sup>

$$\eta^n > \frac{e_u^c}{p} = 1 + \frac{e_u}{p} \quad (29)$$

Expression (29) indicates that there is a scope for increasing the noncooperative saving-investment tax wedge if the marginal cost of public funds,  $\eta^n$ , exceeds  $e_u^c/p$ . Note that in this instance the profit tax,  $z^n$ , is at its maximum value,  $\bar{z}$ , both before and after the coordination of income taxation. For lower values of  $\eta^n$ , and in particular for  $\eta^n = (1-\alpha)e_u^c/(e_u^c - \alpha p)$ , the profit tax is not at its maximum in the uncoordinated case. Hence, condition (31), which is derived on the assumption that  $z = \bar{z}$ , does not apply. In this instance, we saw in section 2 that the noncoordinated capital income tax policy implies that there is a saving subsidy, i.e.  $u < 0$ , while the investment tax,  $v$ , is set to zero. Tax coordination in this case entails the elimination of the saving subsidy and a reduction in public goods provision.

An interesting special case is the case where  $x^n = 0$ , i.e. the noncoordinated capital income tax wedge is zero. In this case, we have  $u^n < 0$ , and  $v^n > 0$ , while  $u^n + v^n = x^n = 0$ . From table 1, we see that in this instance the profit tax will be applied in full, i.e.  $z^n = \bar{z}$ , while the marginal

cost of funds is less than one, i.e.  $\eta^n < 1$ . Using (7) and (8) and noting that  $u^n + v^n = 0$ , we specifically find that,

$$\eta^n = 1 - \frac{\alpha(1-\bar{z})e_u}{e_v + (1-\bar{z})(e_u^c - \alpha p)} \quad (30)$$

Again, coordination implies a cutback of public goods and a lowering of the profit tax rate,  $z^n$ , below  $\bar{z}$  while the saving-investment tax wedge,  $x$ , optimally remains equal to zero. For  $0 < x^n < 1/e_u^c + (1-\bar{z})/e_v$  (and corresponding to values of  $\eta^n$  between  $1 - [\alpha(1-\bar{z})e_u] / [e_v + (1-\bar{z})(e_u^c - \alpha p)]$  and  $1 + e_u/p$ ), tax coordination optimally implies a reduction (but generally not an elimination) of the saving-investment tax wedge. As an example, we can take the case where  $\eta^n = 1$ . From table 1, we see that in this instance in the noncooperative equilibrium we have  $u^n = 0$ ,  $v^n = \alpha(1-\bar{z})/e_v$ , and  $x = \alpha(1-\bar{z})/e_v$ . Condition (29) applies and indicates that coordination leads to a reduction of the saving-investment tax wedge and a corresponding reduction in the provision of the public good. Finally, for  $\eta^n$  between  $(1-\alpha)e_u^c/(e_u^c - \alpha p)$  and  $1 - \alpha(1-\bar{z})e_u/(e_v + (1-\bar{z})(e_u^c - \alpha p))$ , the noncoordinated tax wedge,  $x^n$ , is negative while  $z^n = \bar{z}$ . Tax coordination now entails an elimination of the negative tax wedge  $x^n$ , and a reduction of the public goods provision and of the profit tax below  $\bar{z}$ . The results on the direction of tax coordination and the marginal cost of funds,  $\eta^n$ , in the uncoordinated equilibrium for the case of  $\alpha(1-\bar{z}) > 0$  are summarized as follows,

**PROPOSITION 5.** With some foreign ownership and incomplete profit taxation, tax coordination leads to a reduction in the saving-investment tax wedge if the marginal cost of funds, as perceived by each country in the noncoordinated equilibrium, lies between the values on the right hand sides of equations (29) and (30) and to an increase in this tax wedge outside this interval. Correspondingly, there is an overprovision of the public good if the marginal cost of funds is less than the right hand side of (29), and vice versa.

Essentially, for a marginal cost of funds less than the right hand side of (29), there is an overprovision of public goods, as countries have an incentive to overtax foreigners. This overtaxation can result in a saving subsidy, which should be eliminated, or it can coexist with a positive saving-investment tax wedge, which then should be reduced. For a marginal cost of funds that exceeds the right hand side of (29) there is undertaxation, because the tax authorities do not take into account the positive externality of a higher saving-investment tax wedge that stems from the

positive income effect on foreign saving of a higher domestic saving-investment tax wedge. In this instance, tax coordination leads to a higher saving-investment tax wedge. Figure 1 summarizes the relationships between  $x^a$  and  $x^n$  on the vertical axis, and  $\eta^n$  on the horizontal axis for the case of  $\alpha (1 - \bar{z}) > 0$ .

## 5. *International tax coordination with fewer tax instruments*

The present section considers the scope for tax coordination for the case where in the noncoordinated equilibrium the tax authorities have fewer tax instruments at their disposal. In particular, the tax authorities are assumed to have access to a saving tax combined with a profit tax or to an investment tax combined with a profit tax. The two cases are examined in turn.

### 5.1 *Only saving and profit taxation*

As mentioned in the Introduction, central contributions to the literature on taxation in open economies contend that a small country optimally does not apply source-based capital income taxes. This naturally leads to questioning the widespread use of essentially source-based corporate income taxes in industrialized countries. In this light we first wish to examine what happens if the investment tax no longer is part of the tax instrument set. Accordingly, the authorities are now assumed to have access to only a saving tax and the (possibly restricted) profit tax in the noncoordinated equilibrium.

Again, we start with assuming that there is some foreign ownership, i.e.  $\alpha > 0$ . First, consider the case where we have  $z^n < \bar{z}$ ,  $u^n < 0$  and  $\eta^n = (1-\alpha) / [1 + (1-\alpha) u^n p]$  in the noncoordinated equilibrium. Note that in this instance the absence of the investment tax instrument does not bind tax policy, as the investment tax rate would be set equal to zero if it existed. As in section 4, coordination now implies the elimination of the negative saving tax and a corresponding reduction in the provision of the public good to the point where  $\eta = 1$ . Next, we consider that in the noncoordinated case, we have  $z^n = \bar{z}$ ,  $u^n = 0$  and  $\eta^n = 1$ . We now see from (18) that coordination implies that the saving-tax wedge optimally remains equal to zero. Hence, tax coordination in this instance does not involve any change in tax policy or in the provision of public goods. Finally, we consider that without coordination we have  $z^n = \bar{z}$ ,  $u^n > 0$  and thus  $\eta^n > 1$ . Recognizing that in the absence of the investment tax we have  $u^n = x^n$ , we can evaluate (24) to find that it is equivalent to  $z^n = \bar{z} < 1$ . In words, this means that coordination increases the saving tax rate  $u$  beyond  $u^n$ , unless there is full profit taxation, i.e.  $\bar{z} = 1$ . To see why the saving tax



should be increased with  $u^n > 0$  and  $z^n = \bar{z} < 1$ , note that when countries apply saving taxes, this raises the international interest rate and thereby foreign saving and, in particular, the revenue from saving taxation abroad. This positive externality is overlooked in non-coordinated tax policy and therefore gives rise to an increase in saving tax rates under coordination. In case of full profit taxation (with  $z^n = \bar{z} = 1$ ), we saw before that (i) only the saving tax is used in the noncoordinated equilibrium, and (ii) there are no gains from coordination. Clearly, these conclusions remain valid for this case of  $z^n = \bar{z} = 1$  if the investment tax instrument is not available. Figure 2 summarizes the relationship between  $\eta^n$ ,  $x^n$  and  $x^a$  for the case of  $\alpha(1 - \bar{z}) > 0$ .

Finally, we consider that the share of foreign ownership,  $\alpha$ , is zero. This eliminates the possibility of a negative saving tax,  $u^n$ , in the noncoordinated equilibrium, leaving the cases where (i) we have  $z^n \leq \bar{z}$ ,  $u^n = 0$ , and  $\eta^n = 1$  in which case coordination is unnecessary, and where (ii) we have  $z^n = \bar{z}$ ,  $u^n > 0$ , and  $\eta^n > 1$ , in which case coordination leads to a higher saving tax and public goods provision unless  $\bar{z} = 1$ . This latter case is remarkable. Without foreign ownership of firms, and with both saving and investment taxation available, we found no need for coordination. However, with the investment tax unavailable, this conclusion no longer holds. In fact, the absence of coordination entails a too low saving tax, exactly because the beneficial international repercussions via an increase in the interest rate are not properly taken into account.<sup>8</sup> This section's results are summarized as follows,

**PROPOSITION 6.** If only saving and profit taxes are available, then tax coordination implies (i) the elimination of any negative saving tax (and a corresponding reduction in public goods), (ii) the retention of a zero saving tax and the corresponding maximum profit tax (iii) a higher saving tax (and more public goods but an unchanging profit tax) if the saving tax is positive, unless there is full profit taxation.

Proposition 6 can be compared to Proposition 2 in Mintz and Tulkens (1994), where they show that tax policies in a purely residence-based system of capital income taxation are internationally optimal. The international interest rate, however, is kept constant throughout the analysis. Proposition 6 indicates that with an endogenous international interest rate, there generally remains a scope for international coordination, even if the tax system is according to the pure residence principle.

## 5.2 Only investment and profit taxation

On paper, all industrialized countries de jure impose a residence-based taxation on saving. For at least large savers, however, it is not difficult to escape the taxation of, say, interest by placing funds abroad. Governments also purport to tax the worldwide income of multinational firms according to the residence principle while offering tax credits for foreign source taxes that in practice are subject to substantial limitations. As a result, corporate income taxation more closely follows the source principle (as argued by Keen (1993) and others). At the same time, the corporate income tax in many countries is the major source of capital income tax revenue, as other capital income taxes produce little or even negative tax revenues, owing to, for instance, tax arbitrage between taxable labor and capital income categories, and tax-preferred retirement saving schemes.

Against this background, it is of prime importance to examine the case where the government has access only to the investment and profit taxes. First, let us assume that there is no restriction on the profit tax, i.e.  $\bar{z} = 1$ . In this instance, the authorities will levy only a profit tax at a rate less than or equal to one, but never an investment tax. With  $\alpha = 0$ , there is no scope for tax coordination. With  $\alpha > 0$ , there is always a scope for reducing the level of the profit tax and public goods provision if  $z^n < 1$ , as  $\eta^n = 1 - \alpha$ . With  $z^n = \bar{z} = 1$ , there only is a scope for reducing the profit tax if again  $\eta^n < 1$ .

Next, consider that  $\bar{z} < 1$  with  $\alpha > 0$ . For relatively weak preferences for public goods, only the profit tax,  $z$ , will be used in the noncooperative equilibrium so that  $v = 0$ , while the cost of public goods,  $\eta$ , equals  $1 - \alpha$ . In this instance, tax coordination implies a reduction in the level of the profit tax and of the provision of public goods. With  $\eta$  above  $1 - \alpha$ , each country sets the investment tax,  $v$ , above zero in the noncoordinated case from (8).<sup>9</sup> If in fact  $v^n$  is only slightly positive (with  $\eta^n$  slightly above  $1 - \alpha$ ), then tax coordination implies a reduction in  $v^n$  to zero and a reduction in  $z^n$  below  $\bar{z}$ . Next, consider that  $\eta^n$  is somewhat larger at 1, which implies that  $z^n = \bar{z}$  and  $v^n = \alpha(1 - \bar{z})/e_v$ . This case corresponds to case iv) in table 1 so that the restriction that  $u = 0$  is in fact not binding. Again, in this case tax coordination involves reducing but not eliminating the investment tax,  $v$ . More generally, we wish to consider the scope for tax coordination for an arbitrary, positive noncooperative value of the investment tax,  $v^n$ . Analogously to (25), there is a scope for increasing the saving-investment tax wedge (by way of a larger investment tax) if,

$$\frac{1 - \bar{z}e_s/e_v}{1 - x^n e_s - \bar{z}e_s/e_v} \frac{1 - \bar{z} - e_v v}{(1 - \bar{z})(1 - \alpha)} < 1 \quad (31)$$

Recognizing that  $x^n = v^n$ , we can see that (31) is equivalent to,

$$\eta^n > 1 + \frac{\alpha(1-\bar{z})e_u}{e_v + (1-\bar{z})p} \quad (32)$$

Equation (32) reflects two opposing spill-overs. First, to the extent that domestic firms are owned abroad, and profits are only partially taxed, the investment tax shifts income from foreigners to citizens at home. This mechanism leads to overtaxation of investment. Second, a higher investment tax lowers the international interest rate which entails a rise in investment and thereby investment tax revenues abroad. This second mechanism constitutes a positive externality which is the stronger, the larger is the investment tax rate; clearly, it implies undertaxation of investment. What formula (32) demonstrates is that the first effect dominates for low values of the tax, whereas for high values it is the other way around.

Equation (32) also reveals the key role of the foreign ownership share,  $\alpha$ . First, consider that  $\alpha = 0$ . Now a positive investment tax,  $v^n$ , implies that  $\eta^n > 1$ . The facts of  $\alpha = 0$  and  $\eta^n > 1$  together imply that condition (32) is satisfied so that coordination should lead to a larger saving-investment tax wedge. The absence of a saving tax is a binding constraint on the optimal tax mix, and each country perceives the marginal cost of funds to be larger than it otherwise would be. As a result there is an undertaxation of investment, and coordination optimally increases the investment tax rate. Again we observe a need for coordination, even despite the absence of foreign ownership of domestic firms, because the government lacks one of the two capital income tax instruments. Next, with  $\alpha > 0$  equation (32) indicates that with  $v^n > 0$  coordination may require an increase in the saving-investment tax wedge if  $\eta^n$  is sufficiently large. With  $\alpha > 0$ , tax coordination, however, possibly requires a reduction in the investment tax rate. Figure 3 summarizes the relationship between  $\eta^n$ ,  $x^n$  and  $x^a$  for the case of  $\alpha(1 - \bar{z}) > 0$ . The results can be summarized as follows,

**PROPOSITION 7.** If only investment and profit taxes are available and the investment tax is actually used in the noncoordinated case, then coordination leads to a higher investment tax rate in the absence of foreign ownership. With some cross-ownership, coordination may instead require either an increase or a reduction in the investment tax rate.

Proposition 7 can be compared to several results in the literature. It has long been

contended that countries (regions), that apply taxes on mobile capital employed domestically in order to finance public goods, will impose inefficiently low levels of taxation and thus provide too few public goods. This is shown to hold under certain assumptions in Zodrow and Mieszkowski (1986) and Wilson (1986), and it is established in Proposition 7 above for the case of  $\alpha = 0$ . Both Zodrow and Mieszkowski (1986) and Wilson (1986), however, provide counterexamples where capital is overtaxed and public goods are oversupplied in the non-cooperative equilibrium. In the former article, the overtaxation can occur when the government provides a public input for private production processes rather than a public consumer good. In the latter article, it is due to a multi-sector specification of the economy where public goods production is relatively intensive in the mobile capital. Proposition 7 can likewise explain both an undertaxation and an overtaxation of investment if there is some cross-ownership of firms in the absence of a saving tax.

## 6. *Conclusion*

This paper has considered the scope for international coordination of capital income and profit taxation. In the open economy, capital income taxation consists of either investment or saving taxation or both, while in the closed economy a single tax instrument determines the tax wedge between the returns to saving and investment. A main conclusion in line with earlier contributions is that there is no scope for capital income tax coordination if profits are fully taxed. In the absence of full profit taxation, there still is no scope for coordinated capital income taxation if all domestic firms are domestically owned and if there exist both a saving and an investment tax in the open economy. Introducing foreign ownership of domestic firms opens the possibility that foreign capital is overtaxed. This overtaxation can manifest itself in a saving subsidy to domestic residents (which should be eliminated by coordination), or by a positive saving-investment tax wedge (which should be reduced by coordination). Alternatively, at high levels of spending on the public good and a positive foreign ownership, coordination may require a higher saving-investment tax wedge. The reason is that in the open economy a higher saving-investment tax wedge also lowers foreign profits and thus generates a positive income effect on foreign saving and saving tax revenues. This positive international tax revenue externality of a higher saving-investment tax wedge is overlooked in the absence of policy coordination.

With only saving and profit taxation in the open economy, coordination leads to the elimination of any saving subsidy and a higher saving tax if this tax is positive. Coordination leads to a higher saving tax as each country perceives the excess burden of capital income taxation to be

relatively high if it cannot use an investment tax, regardless of whether there is any foreign ownership. With only investment and profit taxation, coordination leads to a lower investment tax at relatively low levels of public spending. In this instance, tax coordination simply corrects for the overtaxation of capital income resulting from its international ownership. At relatively high levels of public spending, tax coordination leads to higher capital income taxation. This corrects for the undertaxation of capital income that arises as countries cannot use the saving tax instrument.

The paper points at many potential topics for future research. One issue is the role of the foreign ownership share,  $\alpha$ , in determining the scope for policy coordination. With both saving and investment instruments available, policy coordination has been shown to be unnecessary in the absence of any foreign ownership. With some cross-ownership, however, a need for policy coordination arises in our model. This suggests *prima facie* that cross-ownership is undesirable, as the model offers no separate motive for cross-ownership. Alternatively, cross-ownership may be desirable if, say, only the investment tax instrument is available. In this instance, a positive cross-ownership increases an investment tax that otherwise is set too low in the absence of the saving tax instrument. A further issue is to consider that profits may be relocated internationally by multinational enterprises by way of, for instance, transfer pricing. A first step in considering the scope for tax coordination in this instance has been taken in a partial equilibrium setting by Elitzur and Mintz (1994). Finally, political economy considerations may be important in explaining the level and mix of capital income taxes in open economies, as seen in Persson and Tabellini (1995) and Huizinga and Nielsen (1996).

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## Endnotes

1. This tax problem differs from Nielsen and Huizinga (forthcoming) in that our earlier paper assumes that the government can make lump sum payments to domestic residents and that the volume of public goods is given exogenously.
2. Observe that the existence of case i) presupposes that  $\bar{z} > \alpha S/(e_u^c (1-\alpha) [F(K) - (1+r)K])$ , i.e. a high maximum profit tax rate and a high saving elasticity, or a low foreign ownership share. To enrich the subsequent analysis, we assume the inequality to hold. No conclusions in the following are affected by this assumption.

3. The shadow value associated with the maximum profit rate,  $\bar{z}$ , can be seen to be given by,

$$\mu/U_2 = \alpha[F(K) - (1+r+V)]$$

4. Note that  $e_s$  in (22) increases in the profit tax rate,  $z$ , for given coefficients  $e_u$ ,  $p$ , and  $e_v$ . To see why, note that a higher profit tax rate,  $z$ , reduces the income effect of a change in the tax rate,  $x$ , on savings. This renders savings more elastic with respect to the net-of-tax return,  $r - x$ . As a result, the pre-tax return  $r$ , has to rise more to equalize saving and investment for a given tax wedge,  $x$ . The effect of an increase in the profit tax on the interest rate can further be found as,

$$\frac{dr}{dz} = -\frac{p[F(K) - (1+r)K]}{S(e_u + p(1-z) + e_v)}$$

5. In this instance, the optimal tax wedge,  $x$ , from (18) is given by,

$$x = \frac{(V' - U_2)(1 - x \frac{dr}{dx})}{V' e_s}$$

6. In the optimum,  $\eta^n$  equals  $V'(G)/U_2$ .
7. To derive (29), it can be noted from (7) and (8) that,

$$u^n = (1 - \frac{I}{\eta^n}) \frac{I}{e_u}$$

and

$$v^n = \frac{1 - \bar{z}}{e_v} (1 - \frac{1 - \alpha}{\eta^n}) + \frac{1 - \bar{z}}{e_v} p \frac{1 - \alpha}{e_u} (1 - \frac{I}{\eta^n})$$

The expression for  $v_n$  reflects that the marginal cost of public funds is perceived to be lower if a share  $\alpha$  of the burden of the investment tax is effectively borne by the foreign owners of domestic firms. Also, this expression reflects that with  $p > 0$  there are synergies between the saving and investment taxes, as the investment tax has a positive income effect on saving.

8. Another way to see this is to note that a government generally uses both the saving and investment tax instruments (if available) to minimize the (perceived) excess burden. Without the investment tax instrument, the government then naturally chooses an inefficiently low saving-investment tax wedge, and coordination leads to a higher saving-investment tax wedge.



9. In fact, from (8) and noting that  $u^n = 0$ , we find,

$$v^n = \frac{1 - \bar{z}}{e_v} \left( 1 - \frac{1 - \alpha}{\eta^n} \right)$$